Claim 30. (Amended) A [liner for a] shaped charge according to claim 21 wherein

the binder metal is chosen from the group consisting of copper, lead, zinc, tin, and bismuth.

Claim 31. (Amended) A [liner for a] shaped charge according to claim 21 wherein

the binder metal consists [essentially] primarily of lead.

Claim 32. (Amended) A [liner for a] shaped charge according to claim 21 wherein

the mixture further comprises approximately 0.02% to 1.0% lubricant by weight.

Claim 33. (Amended) A [liner for a] shaped charge according to claim 21 wherein

the lubricant comprises powdered graphite. [. .]

Claim 34. (Amended) A [liner for a] shaped charge according to claim 21 wherein

the lubricant comprises oil.

Claim 35. (Amended) A [liner for a] shaped charge according to claim 21 wherein

the [mixture] liner is compressively formed.

Claim 36. (Amended) A [liner for a] shaped charge according to claim 1 wherein

the [mixture] liner is compressively formed.

Claim 37. (Amended) A [liner for a] shaped charge according to claim 11 wherein

[T]the [mixture] liner is compessively formed.

REMARKS

Claims 1-37 are pending in the application. Claims 23 and 24 are canceled. The remaining claims are amended.

Claims 1-3, 5, 10-16, 36 and 37 were rejected under 35 USC 102(b) as anticipated by or, in the alternative, under 35 USC 103(a) as obvious over Kock. As the examiner notes, Kock is drawn to the formation of an impact projectile designed to penetrate armored plate while remaining intact. Kock, Col. 1, ll. 6-20, for example. This is quite different, and actually teaches away, from use of a heavy metal powder liner designed to, upon detonation

of the explosive, form an explosive jet of disintegrated heavy metal powder which is designed to specifically avoid formation of metal fragments. Specification, page 1, line 16 - page 2, line 4. The claims have been amended to require structure for a shaped charge. See amended independent Claims 1, 11, and 21. The teaching of producing a heavy metal bullet which is ductile enough to not bend or shatter upon contact with armored plate is wholly different from Applicants' use of a heavy metal powder liner designed to disintegrate upon explosion.

Claims 4, 7-9, 17-30 and 32-35 were rejected under 35 USC 103(a) as being unpatentable over Kock in view of Riggs. Riggs does not teach the enhancement of use of heavy metal up to 99%. In fact, Riggs uses 80% iron or copper as its base metal, neither of which are heavy metals. Applicants' invention is drawn to increasing the heavy metal content of a shaped charge liner to between 90% and 99.98%. The heavy metal is of high density, high ductility and capable of achieving high acoustic velocity. Specification, page 5, lines 7-9. Applicants limit the definition of "heavy metal," for purposes of this application, to those metals with a specific gravity of at least 16 g/cc. The claims have been amended by omitting the previously listed metals with a specific gravity of less than 16. Riggs teaches the use of base metals which are not heavy metals, and even then only up to 80% by weight. The other 19% by weight is binder metals, specifically lead or tin. Col. 4, lines 6-14. These binder metals are not heavy metals either. Riggs actually teaches away from the replacement of the non-heavy metal base elements, namely iron or copper, by suggesting that the copper cannot be replaced with a heavy metal, but only that "tungsten and antimony" may be "included" in the mixture. Applicants have achieved a higher percentage of heavy metal in a shaped charge liner than previously known. Nowhere does the prior art teach or suggest such a use. Additionally, these claims are allowable as depending from allowable base claims.

Claims 6 and 31 were rejected under 35 USC 103(a) over Kock in view of Reese. These claims are allowable as depending from allowable base claims.

It is believed that the application is in condition for allowance, and such action is respectfully requested. If the examiner is of the opinion that a telephone interview would speed prosecution, please do not hesitate to call Peter V. Schroeder.

The Commissioner of Patents and Trademarks is hereby authorized to charge any fees or overpayments to Deposit Account No. 03-3840. A duplicate copy of this fee authorization sheet is enclosed for this purpose.

Dated: November 25, 2002

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1 A shaped charge comprising:
a casing for a shaped charge;
an explosive material disposed within the casing having a cavity formed therein; and
a mixture of powdered heavy metal and powdered binder metal wherein the percentage of heavy metal in the mixture is within a range of approximately 91.0% to 99.98% by weight.

2 A shaped charge according to claim 1 wherein
the heavy metal powder is chosen from the group consisting of tungsten, tantalum, gold, platinum, or any mixture thereof.

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GROUP

3. A shaped charge according to claim 1 wherein
the heavy metal consists primarily of tungsten.

4. A shaped charge according to claim 1 wherein
the percentage of heavy metal in the mixture is within a range of approximately 99.0% to 99.98% by weight.

5. A shaped charge according to claim 1 wherein
the binder metal is chosen from the group consisting of copper, lead, zinc, tin, and bismuth.

6. A shaped charge according to claim 1 wherein
the binder metal consists primarily of lead.

7. A shaped charge according to claim 1 wherein
the mixture further comprises approximately 0.02% to 0 1.0% lubricant by weight.

8. A shaped charge according to claim 7 wherein
the lubricant comprises powdered graphite.

9. A shaped charge according to claim 7 wherein
the lubricant comprises oil.

10. A shaped charge according to claim 1 wherein
the percentage of heavy metal in the mixture is approximately 93.0%.

11. A shaped charge comprising:
a casing;
an explosive material disposed within the casing having a cavity formed therein; and
a liner disposed within the cavity formed of heavy metal powder, coated with a binder metal, formed into a rigid body.

12. A shaped charge according to claim 11 wherein
the heavy metal powder is chosen from the group consisting of tungsten, tantalum, platinum, gold, or any mixture thereof.

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13. A shaped charge according to claim 11 wherein
the heavy metal comprises tungsten.

14. A shaped charge according to claim 11 wherein
the binder metal is chosen from the group consisting of copper, tin, zinc, lead, bismuth or any mixture thereof.

15. A shaped charge according to claim 11 wherein
the percentage of heavy metal in the heavy metal powder is within a range of approximately 91.0% to 99.98% by weight.

16. A shaped charge according to claim 11 wherein
the percentage of heavy metal in the heavy metal liner is approximately 93.0%.

17. A shaped charge according to claim 11 wherein
the percentage of heavy metal is within a range of approximately 99.0% to 99.98% by weight.

18. A shaped charge according to claim 11 wherein
the heavy metal powder, coated with binder metal, is mixed with approximately 0.02% - 1.0% lubricant by weight.

19. A shaped charge according to claim 18 wherein the lubricant comprises powdered graphite.

20 A shaped charge according to claim 18 wherein the lubricant comprises oil.

A1

21. A shaped charge comprising:

a casing;

an explosive material disposed within the casing having a cavity formed therein; and

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a liner disposed within the cavity formed of a mixture of powdered heavy metal, powdered metal binder, and a heavy metal powder coated with a binder metal formed into a rigid body.

22. A shaped charge according to claim 21 wherein the rigid body is substantially conical.

23. Canceled.

24. Canceled.

A2 cont

25. A shaped charge according to claim 21 wherein the percentage of heavy metal in the mixture is within a range of approximately 90.0% to 99.98% by weight.

26. A shaped charge according to claim 21 wherein the percentage of heavy metal in the mixture is approximately 93.0%.

27. A shaped charge according to claim 21 wherein the heavy metal powder is chosen from the group consisting of tungsten, tantalum, gold, platinum, or any mixture thereof.

28. A shaped charge according to claim 21 wherein the heavy metal consists primarily of tungsten.

29. A shaped charge according to claim 21 wherein the percentage of heavy metal in the mixture is within a range of approximately 99.0% to 99.98% by weight.

30. A shaped charge according to claim 21 wherein the binder metal is chosen from the group consisting of copper, lead, zinc, tin, and bismuth.

31. A shaped charge according to claim 21 wherein the binder metal consists primarily of lead.

32. A shaped charge according to claim 21 wherein the mixture further comprises approximately 0.02% to 1.0% lubricant by weight.

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33. A shaped charge according to claim 21 wherein the lubricant comprises powdered graphite.

34. A shaped charge according to claim 21 wherein the lubricant comprises oil.

35. A shaped charge according to claim 21 wherein the liner is compressively formed.

36. A shaped charge according to claim 1 wherein the liner is compressively formed.

37. A shaped charge according to claim 11 wherein the liner is compessively formed.